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DEPARTMENT OF COMMERCE
CIVIL AERONAUTICS ADMINISTRATION

AR-2
NAVAL AIRCRAFT FACTORY
N3N-1 ← "1"

July 9, 1951

RESTRICTED AIRCRAFT SPECIFICATION

An aircraft of the subject model is considered eligible for restricted airworthiness certification when modified for a special purpose in accordance with Part 8 of the Civil Air Regulations.

Holder of Type Certificate — Crowl Dusters, Inc.
Phoenix, Arizona

Operating Limitations: To be prescribed for the particular special purpose operations in accordance with Civil Aeronautics Manual 8.30-1.

For special purpose operations over congested areas, the military operating limitations must be submitted by the applicant for the use of the CAA representative in establishing civil limitations in accordance with Civil Air Regulations Part 8.30.

... END ...

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DEPARTMENT OF COMMERCE
CIVIL AERONAUTICS ADMINISTRATION

A-2-569
Sheet 1
Revision 5
NAVY
N3N-3

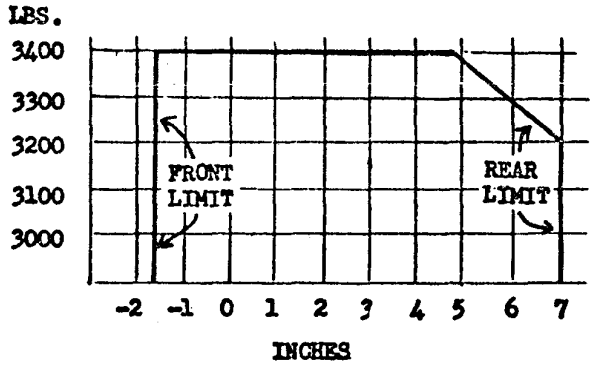
December 21, 1950

AIRCRAFT SPECIFICATION NO. A-2-569

Manufacturer: Naval Aircraft Factory
Philadelphia, Penn.

I - Model N3N-3, 2 POLB

Engine	Wright R-760-2, -4 or -8 built by Naval Aircraft Fact. (Equivalent to Wright R-760E-T) (See NOTE 2 for Lycoming engines and NOTE 3 for P & W TIB-3 engine)
Fuel	73 min. octane aviation gasoline
Engine limits	For all operations, 2000 rpm (235 hp) (See NOTE 1(g) for placard)
Airspeed limits	Level flight or climb 126 mph True Ind. Glide or dive 152 mph True Ind. (Glide or dive speed may be increased to 180 mph True Indicated if Max. Weight is restricted to 2800 lbs.)
Propeller limits	Diameter - not over 102 in. (See NOTE 1(g) for not under 100 in. (additional limitations.
C.G. Range	(-1.6) to (+7.0) at 3200 lbs. or less (-1.6) to (+4.9) at 3400 lbs. Straight line variation between points given.



Empty weight C.G. range	None
Datum	Leading edge of lower wing
Leveling Means	Top surface of upper longerons in either cockpit.
Maximum weight	3200 lbs. (See NOTES 2 and 3 for 3400 lbs.)
No. seats	2 (one at +28 and one at +75)
Maximum baggage	20 lbs. (+100)
Fuel capacity	45 gals. (-11)
Oil capacity	3-3/4 gals. (-31)

Control surface movements	Elevators	- Up 35°; Down 25°
	Elevator tab	- Up 15°; Down 15°
	Rudder	- Right 30°; Left 30°
	Aileron	- Up 30°; Down 18°
Certification basis	CAR 4a.031	
Serial Nos.	All eligible per NOTES 1 and 2	
Required equipment	Items 1, 101, 102, 103, 201, 202, and 403.	

Propeller and Propeller Accessories

1. Propeller - adj. metal - Navy 5406AL or 5406AR hub and 4350F blades (See NOTE 1(e) for restrictions) 86 lbs. (-80)

Engines and Engine Accessories (Fuel and Oil System)

101. Carburetor air heater assy. (See NOTE 1(b) for modifications) 13 lbs.
102. Engine-driven fuel pump - Pesco R-400
103. Hand fuel pump
104. Fire ext. press. type (engine section) (-9)
105. Carburetor air cleaner
106. Starter - hand cranking
107. Engine primer

Landing Gear

201. Bendix 30x5 fabricated wheels (-19.5)
202. 10x3 tail wheel (+183.5)

Electrical Equipment

301. Battery (See NOTE 1(c) for modifications) (-29)
302. Swivel panel light (front and rear)
303. Anchor (turtle back) light
304. Wing position lights
305. Tail light (See NOTE 1 (c) for modifications)

Interior Equipment

401. First-aid kit
402. Fire extinguisher - portable
403. Safety belts (two) - NAF 39941 (+28) & (+75)
404. Venturi tube

NOTE 1. Prior to certification, each aircraft must comply with the following:

(a) Firewall. Firewall either to be completely replaced by, or covered or backed by, one of the following materials:
(1) Stainless steel - .015 in. thick
(2) Nickel-chromium-iron alloy sheet - .015 in. thick
(3) Low carbon steel - .018 in. thick (aluminum coated or otherwise protected against corrosion)
(4) Monel metal - .018 in. thick
(5) Terne plate - .018 in. thick

(b) Carburetor Air Heater. Carburetor air heater to be modified in accordance with Airworthiness Bulletin No. 83.

(c) Electrical System. Battery and battery supports to be removed or, if battery is retained, a master switch, approved type tail light, and battery to be installed and structure adjacent to battery to be painted with acid-proof paint.

(d) Cockpit Air Contamination. The fuselage skin openings around landing gear members and any other openings leading through the bottom of the fuselage or lower wing into the cockpits to be sealed with suitable boots or skin patches

to prevent engine exhaust from entering the cockpits and contaminating the air with carbon monoxide.

(e) Propeller. If 9 ft. dia. propeller is installed, it should be reduced to 8 ft. 6 in. diameter. Pitch setting at 42 in. sta. for 8 ft. 6 in. dia. blades - 11°. Setting may be 14.6° if max. weight is restricted to 2800 lbs. Propeller to be indexed so that blades are 45° ahead of the locating screw on the propeller shaft (in the direction of rotation)

(f) Spin Placard. Placards reading "Intentional Spinning Prohibited" to be installed in both cockpits.

(g) Engine Operation Placard. Placards reading "Avoid Continuous Operation above 1800 rpm or below 1680 rpm" to be installed in both cockpits.

(h) Solo ~~Flying Placard.~~ Placard reading "Fly Solo from Front Cockpit Only" to be installed in rear cockpit unless complete set of engine controls are installed in rear cockpit.

(i) Instrument Marking. Tachometer to be marked at 2000 rpm. Airspeed indicator to be marked at 126 mph and 152 mph.

(j) Fuel and Oil Markings. The words "Fuel", "73 octane", and "45 gallons" to be marked on or adjacent to fuel filler cap. The words "Oil" and "3-3/4 gallons" to be marked on or adjacent to oil filler cap.

NOTE 2. Eligible for installation of Lycoming R-680-E3, -E3A, or -E3B engine (military designation R-680-9 or R-680-13). The following are applicable to this installation:

(a) Fuel - min. 87 octane aviation gasoline.

(b) Engine limits: Maximum continuous, 2200 rpm (285 hp)
Take-off (one minute), 2300 rpm (300 hp)

(c) Airspeed limits:
Level flight or climb 126 mph True Ind.
Glide or dive 164 mph True Ind.

(d) Propeller - Ham. Std. Constant Speed, 2B20 Hub, 6135A-9 Blades, 1012-A1 Governor.

(e) Propeller limits: Pitch settings at 42 in. sta. -Low 9°, high 19°; dia. 8' 3" max., 8' 1" min.

(f) Powerplant installation - AT-10 exhaust, carburetor heater muff, and oil tank (6 gals.) may be installed without modification. No cowling or engine baffles may be used unless flight tested by CAA representatives.

(g) Maximum weight - 3400 lbs. provided that wheels and tires having an approved rating of 1700 lbs. each (or greater) are installed. (BT-13 or BT-15 wheels, tires, and axles are satisfactory.)

(h) Engine mount - Satisfactory engine mounts have been substantiated by the following modifiers:
Brandt, Perkins, and Brandt, Marysville, Calif., Drawing No. 1.
Rankin Aviation Industries, Tulare, Calif., Drawing dated February, 1947.
South Delta Aviation Service, Rolling Fork, Miss., Original R-760 mount modified for Lycoming R-680 engine.

(i) Fuel pumps - Wobble (U.A.P. Type D-2) Engine Driven (AN 4100 CE)

(j) NOTE 1, parts (b), (e), (g), (i) and (j) are not applicable to this installation. Required equipment items 1, 101, 102, 103, and 201 should be replaced by corresponding items specified in this note.

NOTE 3. Eligible for installation of Pratt and Whitney T1B-3 (R-985-AN-1 or -AN-3) engine. The following are applicable to this installation:

(a) Fuel - minimum 87 octane aviation gasoline

(b) Engine limits - Maximum continuous, 37.5 in. Hg., 2300 rpm (450 hp)
Take-off (one minute), 37.5 in. Hg., 2300 rpm (450 hp)
With these power ratings, a minimum of 67½ gals. of fuel capacity must be provided except in Restricted Category aircraft (certificated prior to October 11, 1950) in which case the airplane must be placarded to be re-fueled for each hour of operation.

240
400

(c) Airspeed limits - Level flight or climb 100 mph True Ind.
Glide or dive 120 mph True Ind.

(d) Propeller
(1) Ham. Std., two-position, 2D30 hub, 6101A-12 to -18 blades
Diameter - not over 108 in., not under 102 in.
Low pitch limit at 42 in. R. 13.5°
High pitch limit at 42 in. R. 18.0°.
(2) Western Propeller Co. model W2-1-9'-0" (ground adjustable)
Diameter - not over 108 in., not under 106 in.
Pitch setting at 42 in. R. 12.5°.
(3) Ham. Std., 5406 hub with 1945-6 blades, 1C1-12 blades, 33C1 blades or A3A1-12 blades
Diameter with 1C1-12 blades - not over 108 in., not under 100 in.
Pitch setting at 42 in. R. 12.5°.
Diameter with 1945-6, 33C1 or A3A1-12 blades - not over 108 in., not under 106 in.
Pitch setting at 42 in. R. (33C1 blades) 12.5°
Pitch setting at 42 in. R. (A3A1-12 blades) 12.5°
Index A3A1-12 propeller at 0° to crank throw
Pitch setting at 42 in. R. (1945-6 blades) 13.3°.

(e) C.G. range - (-1.6) to (+4.9) at 3400 lbs.

(f) Powerplant installation: BT-13 exhaust collector, carburetor heater muff, oil tank, oil cooler (Model U.A.P. U-3170-W-D5) and air cleaner may be installed provided the heater muff is suitably modified to insure adequate heat rise. No outside cowling or engine baffles may be used unless flight tested by CAA representatives.

(g) Maximum weight - 3400 lbs. provided that wheels and tires having an approved rating of 1700 lbs. each (or greater) are installed. (BT-13 or BT-15 wheels, tires and axles are satisfactory.) (For Restricted Category take-off weight for airplanes certificated prior to October 11, 1950, see NOTE 4.)

(h) Engine mount - Satisfactory engine mounts have been substantiated by the following modifiers:
(1) Marsh Aviation Co., P. O. Box 1031, Phoenix, Arizona.
Dwg. No. MA-3.
(2) Albert D. Waite, 3133 McKinley Blvd., Sacramento, Calif.
Dwg. No. 1
(3) Quick Flying Service, 2427 E. Buchanan St., Phoenix, Arizona.
Dwg. No. Q985N3
(4) Goettl's Metalcraft Co., 2431 E. Buchanan St., Phoenix, Arizona
Dwg. No. G2352M

(i) Fuel pumps -
(1) Engine-driven Chandler Evans, Type F (AN4100)
(2) Hand wobble model U.A.P. D-3

(j) NOTE 1 parts (b), (e), (g), (h), (i) and (j) are not applicable to this installation.

NOTE 4. Model N3N-3 aircraft which are eligible for 3400 lbs. and were certificated in the Restricted Category prior to October 11, 1950, may continue to be operated with the following limitations with the engines listed in NOTES 2 or 3:

(a) Maximum take-off weight	3740 lbs.
Maximum landing weight	3400 lbs.
*Maneuvering speed at maximum weight	114 mph
C.G. range	(-1.6) to (+4.9)

(b) The following placards must be in full view of the pilot:
(1) * "Maneuvering speed at maximum weight not to exceed 114 mph."
(2) "Intentional spins prohibited."

All original certification in the Restricted Category after October 11, 1950, must be in accordance with CAR and CAM 8.

* Airplanes with "Level flight or climb" speed less than 114 mph should have "maneuvering" speed reduced to correspond with "level flight or climb" speed.

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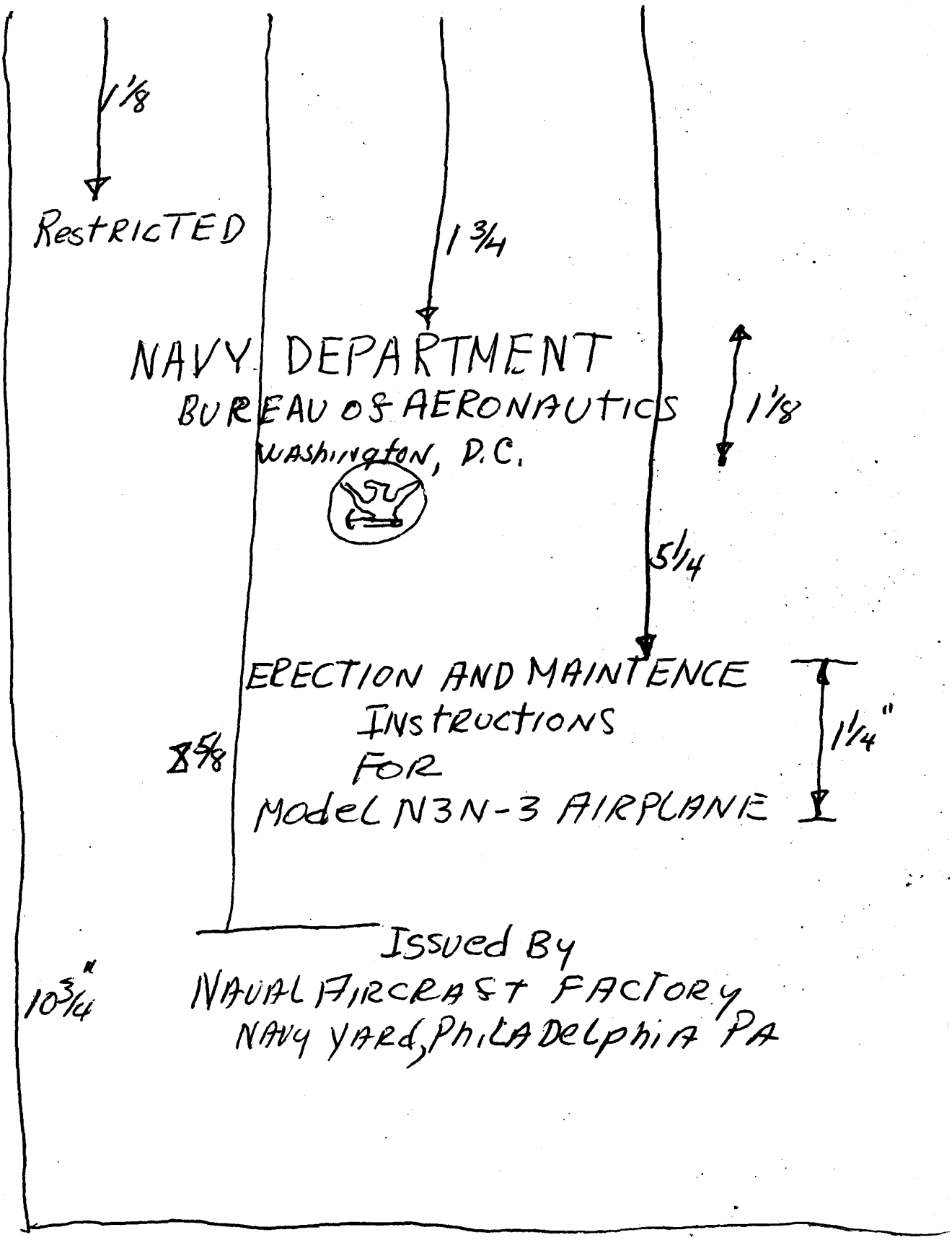
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ERECTION AND MAINTENCE
INSTRUCTIONS
FOR
MODEL N3N-3 AIRPLANE
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ISSUED BY
NAVAL AIRCRAFT FACTORY
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Cover

WEIGHT AND BALANCE DATA

FOR N3N-3 AIRPLANE

BUREAU NO. 2617

SECTION 1

INTRODUCTION . . .

1. GENERAL.

a. The purpose of this Handbook is to provide a standardized and simple method for computing the correct loading of an airplane, and to create a permanent record of these data for the benefit of operators and pilots.

b. Improper loading cuts down the efficiency of an airplane from the standpoint of both performance and maneuverability. It can cause the failure of a flight, with resultant loss of life and destruction of valuable equipment.

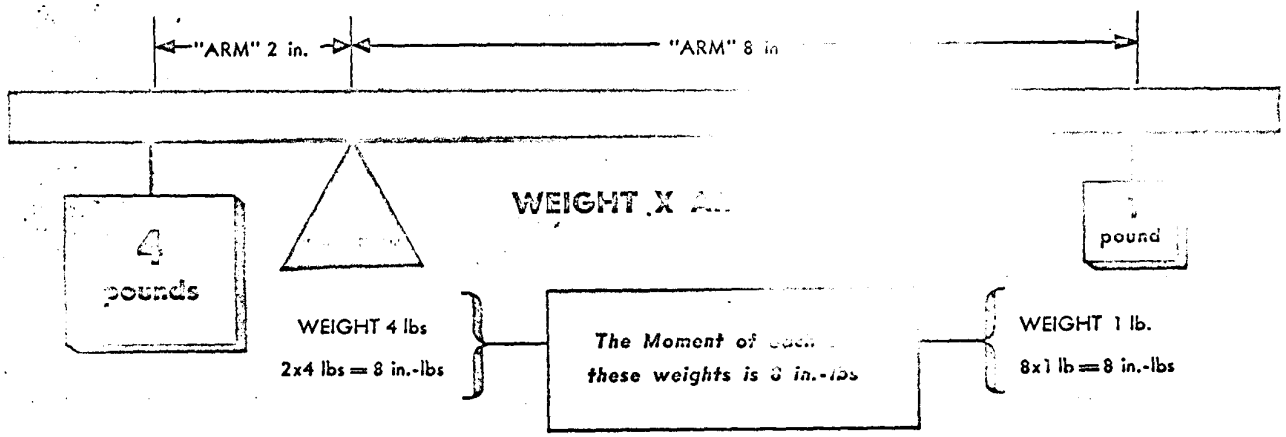
2. PRINCIPLES OF BALANCE.

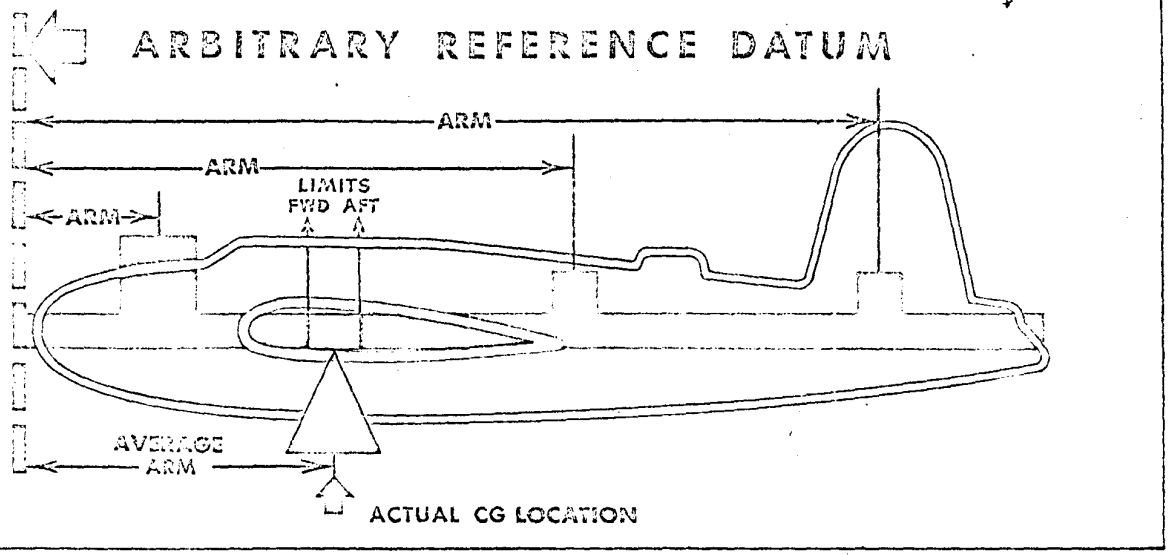
a. The theory of aircraft weight and balance is extremely simple. It is that of the old familiar steelyard scale which is in equilibrium or balance when it rests on the fulcrum in a level position. It is apparent that the influence of weight is directly dependent on its distance from the fulcrum and that for equilibrium or balance, the weight must be distributed so that the turning effect is the same on one side of the fulcrum as on the other. A heavy weight near the fulcrum has the same effect as a lighter weight farther out on the bar.

b. The steelyard scale is in balance only when the horizontal center of gravity (CG) is at one location, i.e., the fulcrum. An airplane, however, can be balanced in flight with the CG anywhere within the specified forward and aft limits by operation of trim tabs or elevators. CG locations outside the specified limits will result in unsatisfactory or dangerous flight characteristics. This allowable variation is called the CG range and its exact location, which is always near the forward part of the wing, is specified for each airplane model. Obtaining this balance is simply a matter of distributing the load so that the CG of the loaded airplane falls within the allowable range. Heavy loads near the wing location can be balanced by much lighter loads at the nose or tail of the airplane. The moments of the loads determine this exactly.

c. In practice, it has been found desirable to measure all distances from an arbitrary reference datum at or near the nose of the airplane. By measuring all arms in the same direction, all moments become positive, thus eliminating possible errors in adding plus and minus moments that result from a reference datum located within the limits of the airplane.

d. When the total moment about this reference datum is divided by the total weight, the resulting





arm is the distance to the center of balance, or CG, from the reference datum. If the CG falls within the specified limits, the loading is satisfactory; otherwise, the load must be shifted until the CG falls within the limits.

c. The allowable CG range is determined by calculations and flight test. Limits are usually expressed as a percentage of the mean aerodynamic chord of the wing (percent M.A.C.), or in inches from the reference datum.

d. To obtain the gross weight and corresponding CG location of the loaded airplane, it is necessary first to know the basic weight and CG location of the airplane. This may be found by weighing the basic airplane as described herein.

e. When the weight, arm and moment of the basic airplane are known, it is not a difficult matter to compute the effect of fuel, crew, cargo, armament and other expendable weight as they are added. This is done by adding all the moments of these additional items to the total moment found by weighing the airplane and dividing by the sum of the basic weight and the weight of these additional items. This establishes the CG for the loaded airplane. The calculations may be performed by arithmetic, loading graphs, or a balance computer.

3. AIRCRAFT WEIGHINGS.

a. Aircraft must be weighed when:

(1) Major modifications or repairs are made.

(2) The pilot reports unsatisfactory balance conditions.

(3) The basic data contained herein are suspected to be in error.

b. Weighing with calibrated scales is the only sure method of obtaining accurate basic weight and CG location of an airplane.

Note

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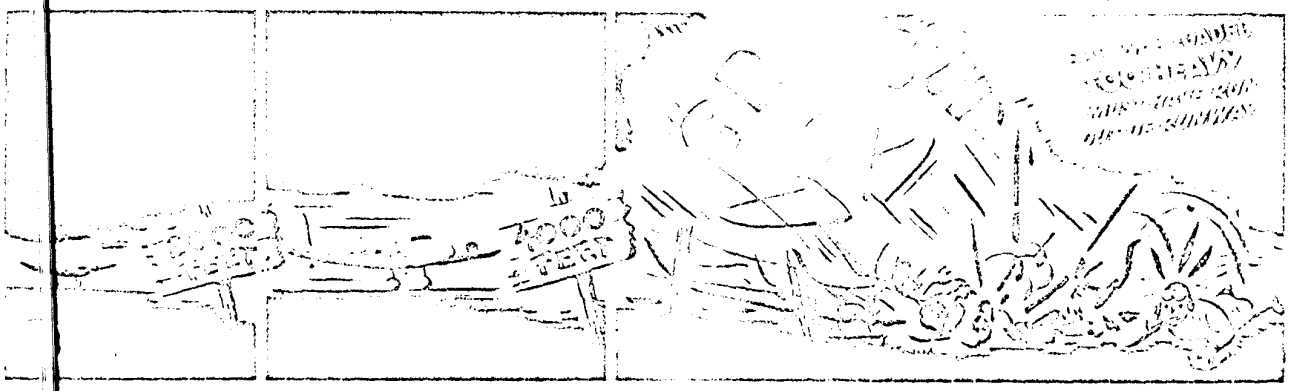


DEFINITIONS

The following definitions will serve as standardized terminology for all data in the practical application of this system. It is important to know them thoroughly.

WEIGHT.—All weights are given in the avoirdupois system. Weight totals are to be given to the nearest whole pound.

BASIC WEIGHT.—The weight of an airplane, including all operating equipment that has a fixed location and is actually present in an airplane; that is, air frame; power plant and accessories; trapped fuel and oil; full hydraulic cooling and anti-icing fluid systems and reservoirs; armor plate; ordnance (less ammunition and bombs); chemical, navigation, oxygen, pyrotechnics, and radio equipment. It never includes items commonly referred to as "disposable."

Note

The basic weight of an airplane varies with modifications and changes in the fixed operating equipment. This is not to be confused with Weight Empty which is a dry weight with certain contract equipment only.

The term "Basic Weight", when qualified with a word indicating the type of mission, such as "Basic Weight for Combat", "Basic Weight for Ferry", etc., may be used in conjunction with directives stating what the equipment shall be for these missions; for example, extra fuel tanks and various items of equipment installed for long range ferry flights which are not normally carried on combat missions will be included in "Basic Weight for Ferry" but not in "Basic Weight for Combat."

GROSS WEIGHT.—The total weight of an airplane and its contents.

REFERENCE DATUM.—An imaginary vertical plane at or near the nose of the airplane from which all horizontal distances are measured for balance purposes. Diagrams of each airplane show this reference datum as balance station zero.

ARM.—For balance purposes, the horizontal distance in inches from the reference datum to the CG of the item.

MOMENT.—The weight of an item multiplied by its arm. Moment divided by a constant is often used to simplify balance calculations by reducing the number of digits. In this Handbook Moment/1000 has been made standard practice.

AVERAGE ARM.—The arm obtained by adding the weights and moments of a number of items and dividing the total moment by the total weight.

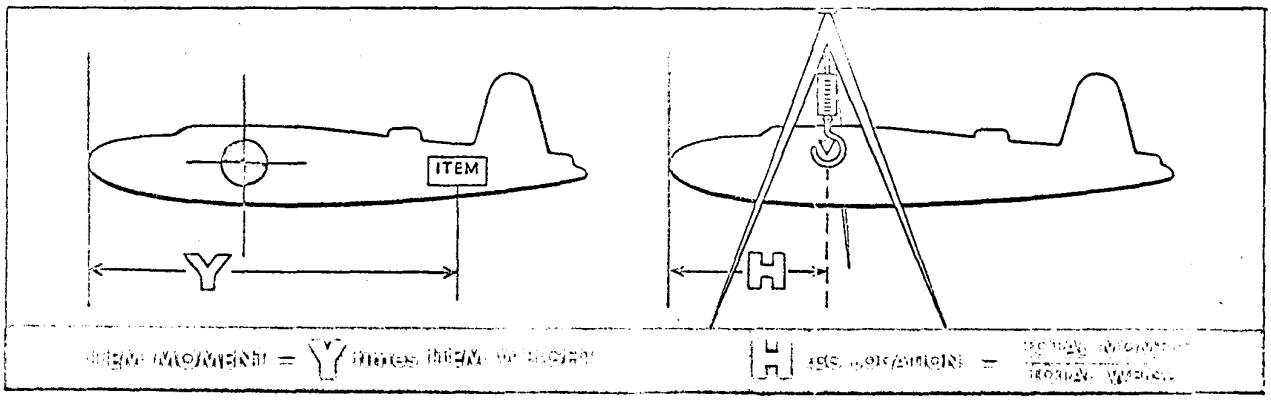
BASIC MOMENT.—The sum of the moments of all items making up the basic weight. When using data from an actual weighing of an airplane, the basic moment is the total moment of the basic airplane with respect to the reference datum.

CENTER OF GRAVITY (CG).—The point about which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the gross weight of the airplane.

CG LIMITS.—The range of movement which the CG can have without making the airplane unsafe to fly. The CG of the loaded airplane must be within these limits at take-off, in the air and on landing. In some cases, take-off and landing limits may also be specified.

TARE.—Weight of equipment necessary for weighing the airplane (chocks, blocks, slings, jacks, etc.) which is included in the scale readings but is not a part of the basic weight.

BALANCE COMPUTER INDEX.—A number representing the moment which, when considered in conjunction with the weight, gives the CG position.



SECTION 2

INSTRUCTIONS FOR USE OF CHARTS AND FORMS

1. GENERAL.

There are two parts to the weight and balance problem. First, one must have correct information as to the basic weight and moment. Second, gross weight and balance must be maintained within safe limits with the addition of load. The first part is controlled by charts A and C after the basic weight and balance have been determined by weighing the airplane. The second part is carried out on form F with the aid of a balance computer or chart E.

2. PRELIMINARY WEIGHING INSTRUCTIONS.

a. Assemble the necessary equipment, including scales, hoisting equipment, jacks, cribbing, leveling bars and level, measuring tape, plumb bobs and string.

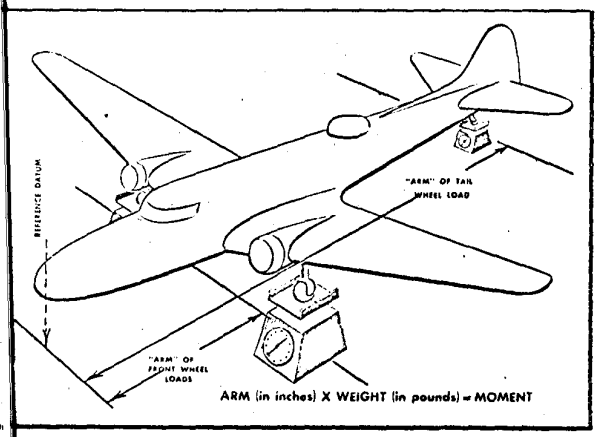
b. Remove dirt, grease, moisture, etc., from the airplane.

c. Drain fuel from all tanks, using tank drains, with the airplane in its normal attitude on the ground.

d. Drain oil from the oil tanks, using the tank drains. If impracticable to drain them, fill them to capacity.

e. Fill reservoirs for drinking and washing water, hydraulic, anti-icer and cooling fluids, etc., to normal level.

f. Inflate or deflate main landing gear oleo struts to normal extension or to the anticipated desired height. It may be helpful for leveling and in jacking to lash a rope around the torque arm of the nose or tail wheel oleo or to apply a stiffener so that the strut will not extend when the airplane is lifted. The nose wheel may be blocked to prevent turning.



g. Conduct an inventory of the fixed operating equipment actually installed in the airplane. This shall be accomplished on chart A.

h. Release the brakes before the airplane is placed on the scales so as to reduce the possibility of side loads and thrusts on the scales which may give erroneous weighing results.

Note

The airplane must be weighed in a closed hangar.

3. USE OF THE AIRPLANE WEIGHING FORM.

a. Fill in the identifying data and enter the actual scale readings in the first column.

b. Subtract tare, if any, from the scale readings to obtain the net weight.

c. Determine arms E and F from the measurements recorded. Be sure to read the measuring tape graduations correctly.

d. Multiply the subtotal net weight of the main wheels and the net weight of the nose or tail wheel by their respective arms (dimensions E and F) to obtain their moments.

e. Add the net weights and moments of the main wheels and nose or tail wheel.

f. Divide the total moment by the total net weight to obtain the CG position in inches from the reference datum (H).

g. Transfer the "TOTAL (as Weighed)" weight, arm and moment to the back of the weighing form.

h. Subtract the oil weight and moment from the "TOTAL (as Weighed)" total. (Arm of oil tanks may be found on the balance computer or on chart E.)

i. Subtract the total weight and moment/1000 of items entered in column I.

j. Add the total weight and moment of the items listed in column II. These items must be checked on chart A as "IN AIRPLANE" to indicate their inclusion in the basic weight.

k. Enter the new basic weight and moment/1000 on chart C. *All subsequent airplane loadings will be based on these figures.*

l. Include under "REMARKS" information as to the type of scales used, attitude of the airplane when weighed, method of support, etc.

4. CHART A—BASIC WEIGHT CHECK LIST.

a. General.

(1) The Basic Weight Check List is a tabulation of all operating equipment that is or may be installed and for which provision or fixed storage has been made in a definite location in the airplane. It gives the weight, arm and moment/1000 of the individual items for use in correcting the basic weight and moment on chart C as changes are made in this equipment. When check marks are entered in the "IN AIRPLANE" column, it serves as the inventory of equipment included in the basic weight and moment/1000.

(2) Inventories should be made periodically, but are required specifically when:

(a) The airplane is modified.

(b) The airplane is assigned to a new base.

(c) Changes in equipment are made for a different type of operation or mission.

(d) The airplane is reweighed.

b. Use.

(1) The manufacturer of the airplane placed check marks in the "DELIVERY EQUIPMENT" column to identify the items of equipment actually installed in the airplane for the delivery condition. This delivery inventory shows equipment included in the initial basic weight entry on chart C.

(2) Subsequent check list inventories shall be carried on as follows:

(*a*) Inspect the airplane for equipment actually installed, placing check marks in the next unused "IN AIRPLANE" column. A check (√) in the column headed "IN AIRPLANE" indicates the presence of the item in the airplane on the date at the head of the column, and a zero (0) indicates its absence. Items should not be checked unless they are installed, and items marked zero are not to be included in the basic weight and balance tabulated on chart C for the corresponding date. During this inventory note whether any new items of equipment have been installed, and if so, enter the name or description together with other data required through column "MOMENT/1000", including the date in parenthesis following the description.

(*b*) Compare this inventory with that under the last "CHECK" heading, noting any changes in the items of equipment installed in the airplane. Refer to chart C to ascertain whether the necessary weight and moment corrections have been made. If so, place check marks opposite such items in the "CHART C ENTRY" column. If not, correct the basic weight and moment/1000 data on Chart C and then enter the "CHART C ENTRY" column check marks.

(*c*) Check marks are made only at the time of a complete inventory. Never change the check marks or add new ones under a previously accomplished check heading. Use the next "CHECK" column. When an inventory is included as part of a weighing, the procedure outlined in the preceding paragraph should not be omitted since this correction

CHART A SHEET

BASIC WEIGHT CHECK LIST

AIRPLANE MODEL SAMPLE SERIAL NO.

ENTER DATE ◊

• RECORD OF CHECKING •

MAY 5 1944

COMPARTMENT & ITEM NUMBER	ITEMS AND LOCATION GROUPED BY COMPARTMENT	WEIGHT	ARM	MOMENT 1000	DELIVERY EQUIPMENT	CHECK 1	CHECK 2	CHECK 3	CHECK 4	CHECK 5	CHECK 6	CHECK 7	CHECK 8
						IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY	IN AIRPLANE / CHART C ENTRY
A	NOSE COMPARTMENT (0" - 93")												
A-1	(2) .50 Cal. Nose Turret Guns and Accessories	148	13	1.1	✓	✓							
A-2	Nose Turret (incl. 21 lb. Armor)	416	13	5.4	✓	✓							
A-3	Bombsight	32	41	1.3	✓	✓							
A-4	Stabilizer	44	41	1.8	✓	✓							
A-5	Bombsight Heater Pad (5-1-44)	6	41	0.2		✓	✓						
A-6	Bomber's Knee Pad	7	70	0.5	✓	✓							
A-7	Fire Extinguisher, Type A-2	7	81	0.6	✓	✓							
A-8	Driftmeter and Mount (5-1-44)	23	84	1.9	✓	0	✓						

1. A check mark in the "IN AIRPLANE" column indicates that the item is still installed. No check mark is required in the "CHART C ENTRY" column.

2. A check mark in the "IN AIRPLANE" column indicates the presence of the item. In this instance it indicates the installation of an item not previously installed. A check mark in the "CHART C ENTRY" column indicates that a corresponding correction of chart C has been made.

3. A zero in the "IN AIRPLANE" column indicates the absence of the item at the time of this inventory. In this instance, it indicates the removal of an item previously installed. A check mark in the "CHART C ENTRY" column indicates that a corresponding correction of chart C has been made.

makes possible the comparison of calculated and actual ght figures. Check marks in the "CHART C TRY" columns indicate only a *calculated* change the basic chart C figures.

(*d*) Make sure that the same date is entered ver the "CHECK" heading on chart A and in the ate column on chart C for the corresponding cor-ected basic weight and moment/1000.

5. CHART C—BASIC WEIGHT AND BALANCED RECORD.

a. General.—Chart C is a continuous history of hanges made in the structure or equipment which ffect an airplane's basic weight, moment and in-ex. At all times *the last weight, moment/1000 and ndex entry is considered the current weight and balance tatus of the basic airplane.* The basic index for the alance computer can be determined by means of the ormula shown on the computer or included in the nstructions for use of the computer.

b. Use.

(1) At time of delivery of a new airplane, the anufacturer entered on this chart the basic weight, oment/1000 and index of the airplane. The item-ed list of the equipment included therein is shown nd checked on chart A in the "DELIVERY EQUIP-IENT" column.

(2) Make additions or subtractions to the basic ght and moment in chart C:

(*a*) Whenever equipment is added to or re-oved from the airplane. If the item is listed on hart A, enter the identical item number, description nd applicable weight and oment data on chart C. f the item is not listed n chart A, determine its tual weight and arm nd record this informa-on on both chart A and hart C.

Note

Do not enter check marks on chart A for these items until a complete inventory is made, but enter the date in parenthesis following the description.

(*b*) Whenever a com-ete inventory reveals ipment changes not viously recorded. Post uipment changes as noted ove. Date the newly calculated basic weight and moment to correspond with the date entered at the head of the "CHECK" column on chart A identifying the equipment content of the new figures. It is also helpful to record the check column number which substantiates this new basic weight and moment.

(*c*) Whenever structural changes are made in the airplane. If the structural changes are provisions for equipment, list them separately from the equipment to be installed thereon.

(*d*) Whenever the airplane is reweighed. Before weighing, make a complete inventory and bring calculated chart C figures up to date. Enter the new "As Weighed" basic weight and moment from the Airplane Weighing Form.

(3) Any change or modification which is caused by a specific order should carry a reference to the order number and date which authorizes the change.

(4) If the index of the airplane is changed as a result of changes in the fixed operating equipment or because of structural changes made in the airplane, the index on the data card of the balance computer's carrying case *must* be changed to agree.

Note

The date entered on chart C must be consistent with the date entered on the top of the "CHECK" column on chart A and with the date on the Airplane Weighing Form if used.

6. CHART E—LOADING DATA.

a. The loading data on chart E are intended to provide information necessary to work a balance problem

AN 01-1B-40

• BASIC WEIGHT and BALANCE RECORD •

CONTINUOUS HISTORY OF CHANGES IN STRUCTURE OR EQUIPMENT AFFECTING WEIGHT & BALANCE

AIRPLANE MODEL SAMPLE SERIAL NO. _____

CHART C SHEET

DATE	ITEM NO. IN	ITEM NO. OUT	DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE ADDED (+) WEIGHT	ADDED (+) MOMENT/1000	REMOVED (—) WEIGHT	REMOVED (—) MOMENT/1000	RUNNING TOTAL BASIC AIRPLANE WEIGHT	RUNNING TOTAL BASIC AIRPLANE MOMENT/1000	RUNNING TOTAL BASIC AIRPLANE INDEX
3-27-44			DELIVERY					38,777	11,202	54.0
4-13-44			A-19 Erco Nose Turret Provisions							
		✓	Structure Removed			215	5.1			
	✓		Structure Added	207	7.5					
			Navigator Relocation							
		✓	Minor Items Removed			32	2.5			
	✓		Minor Items Added	30	0.8					
		✓	Structure Removed			16	1.1			
	✓		Structure Added	24	4.7					
			B-4 Provisions for Additional Bomb Racks	13	2.1					
			TOTALS	274	21.1	263	8.7	38,788	11,214	55.0
5-1-44	A-5		Bombsight Heater Pad	6	.2			38,794	11,214	55.0
5-1-44		A-8	Driftmeter and Mount			23	1.9	38,771	11,212	55.4
5-5-44			Calculated Basic (Check Col. # 1)					38,771	11,212	55.4
5-5-44			As Weighed (Check Col. # 1)					38,814	11,215	54.5

for the airplane to which this handbook is applicable in the event a balance computer is not available.

b. From the loading graphs or tables, weight and moment/1000 are obtained for all variable load items and are added arithmetically to the current basic weight and moment/1000 (from chart C) to obtain the gross weight and moment. The CG of the loaded airplane is represented by the intersection of the gross weight and moment lines on the CG graph or by a moment figure if tables are used. If the airplane is loaded within the forward and aft CG limits, the intersection will fall between the limiting CG lines on the CG graph, or if a table is used, the moment figure will fall numerically between the limiting moments. The effect on the CG of the expenditure in flight of such items as fuel and bombs may be checked by subtracting the weights and moments of such items from the take-off gross weight and moment and replotting on the CG graph or checking the new moment with CG table. This check should be made to determine whether or not the CG will remain within limits during the entire flight.

7. FORM F—WEIGHT AND BALANCE CLEARANCE.

a. General.

(1) To use a balance computer or loading graph satisfactorily, the total of variable loads in each compartment must be known and tabulated on form F.

(2) Form F is the summary of the actual disposition of load in the airplane. It records the balance status of the airplane step by step. It is necessary to accomplish form F prior to flight whenever an airplane is loaded in a manner for which no previous tabulation is available.

(3) Form F is furnished in an expendable pad which can be replaced when exhausted. This pad is loose leaf and has provisions for making duplicate copies. Original sheets may be removed to serve as certificates of proper balance, carrying the signature of responsibility.

Note

It is recommended that one copy of form F completed for the current basic weight remain in the Handbook with the airplane. This will be an aid to personnel responsible for later loadings.

b. Use.

TACTICAL

(1) Insert the necessary identifying information at the top of the form. Enter the Recommended Max. Take-off and Recommended Max. Landing Gross Weights and the permissible CG limits (obtain from chart E).

(2) Ref. 1.—Enter the basic airplane weight and index or moment. Obtain these figures from the last entry on chart C.

Note

If a balance computer is installed in the airplane, enter opposite Ref. 1 the "Index" figure obtained from Chart C. If the "Index" figure is entered, use index figures throughout the form and enter the plate number of the computer (located on the left end of the base of the computer) in the box marked "REMARKS". If chart E is used in the absence of a balance computer, enter the moment figure for the basic airplane opposite Ref. 1 and use moment figures throughout the form.

(3) Ref. 2.—Enter the amount and weight of the oil.

(4) Ref. 3.—Using the same compartment name and letter designation as shown on the back of the balance computer, enter the number and weight of the crew, baggage, cargo and miscellaneous items. Enter the total of each compartment in the "Weight" column.

TRANSPORT AND CARGO

(1) Insert the necessary identifying information at the top of the form. Enter the Recommended Max. Take-off and Recommended Max. Landing Gross Weights and the permissible CG limits (obtain from chart E).

(2) Ref. 1.—Enter the basic airplane weight and index or moment. Obtain these figures from the last entry on chart C.

Note

If a balance computer is installed in the airplane, enter opposite Ref. 1 the "Index" figure obtained from chart C. If the "Index" figure is entered, use index figures throughout the form and enter the plate number of the computer (located on the left end of the base of the computer) in the box marked "REMARKS". If chart E is used in the absence of a balance computer, enter the moment figure for the basic airplane opposite Ref. 1 and use moment figures throughout the form.

(3) Ref. 2.—Enter amount and weight of oil.

(4) Ref. 3.—Enter the number and weight of the crew.

(5) Ref. 4.—Enter the sum of the figures opposite Ref. 1, the totals under Ref. 2 and the compartment totals under Ref. 3 opposite "MINIMUM LDG. GR. WT."

(6) Ref. 5.—Enter by compartment the number of rounds, caliber and weight of all ammunition.

(7) Ref. 6.—Enter the size, distribution (external, bomb bay, etc.) and weight of all bombs.

(8) Ref. 7.—Enter the number of gallons and weight of fuel. If external or bomb bay fuel is carried, make appropriate entries to that effect in the space provided.

(9) Ref. 8.—Add the weights opposite Ref. 4, 5, 6 and 7 and enter the total opposite "TAKE-OFF CONDITION (UNCORRECTED)." At this point, if not already done, calculate and enter the "Moment" or progressive "Index" for Ref. 2 to 8 inclusive.

(10) Check the weight figure opposite Ref. 8 against the Recommended Max. Take-off Gross Weight in the Limits table. Check the "Index" or "Moment" figure opposite Ref. 8 by means of the balance computer or chart E respectively, to ascertain that the indicated CG is within allowable limits.

(11) Ref. 9.—If changes in the amount or distribution of load are required, indicate necessary adjustments by proper entries in the Correction Table. Enter a brief description of the "adjustment" made in the column marked "ITEM." Add all weight and moment *decreases* and insert the totals in the spaces opposite "Total Weight Removed." Add all weight and moment *increases* and insert the totals in the spaces opposite "Total Weight Added." Subtract the smaller from the larger totals and enter the differences (with applicable + or — sign) opposite "Net Difference." Transfer these "Net Difference" figures to the spaces opposite Ref. 9.

(12) Ref. 10.—Enter the sums of or the differences between Ref. 8 and 9 opposite Ref. 10, "TAKE-OFF CONDITION (Corrected)." Recheck to assure that these figures do not exceed allowable limits.

(5) Ref. 4.—Enter the weight of the crew's baggage.

(6) Ref. 5.—Enter the weight of the steward's equipment.

(7) Ref. 6.—Enter the weight of any emergency equipment.

(8) Ref. 7.—Enter the weight of any extra equipment.

(9) Ref. 8.—Enter the sum of the weights opposite Ref. 1 through Ref. 7 inclusive.

(10) Ref. 9.—Enter the number of gallons and weight of fuel. List under "REMARKS" the fuel tanks concerned and the amount of fuel in each tank. If external or bomb bay fuel is carried, make appropriate entries to that effect in the space provided.

(11) Ref. 10.—Enter the sum of the weights opposite Ref. 8 and Ref. 9.

(12) Make a preliminary estimate by entering the Allowable Gross Weight (Rec. Max. Gross Weight) in the space provided in the Preliminary Estimate box in the upper left hand corner of the form. Enter the "Total Airplane Fuel Weight" (from Ref. 10). Subtract the figure opposite "TOTAL AIRPLANE & FUEL WT." from the figure opposite "ALLOWABLE GROSS WEIGHT" and enter the difference opposite "ALLOWABLE LOAD." This figure represents the maximum amount of weight which may be distributed throughout the airplane in the various compartments without exceeding the Recommended Maximum Gross Weight of the airplane.

(13) By referring to the Center of Gravity Graph on chart E, or to the Center of Gravity grid on the balance computer, compute the take-off CG position in terms of % M.A.C. Enter this figure in the space provided opposite "TAKE-OFF CG IN % M.A.C."

(14) Secure necessary approval and signatures at the bottom of the form.

(13) Ref. 11.—Using the same compartment name and letter designation as shown on the back of the balance computer, enter the number and weight of passengers, baggage, mail and cargo. Enter the total of each compartment in the Weight column.

Note

The sum of the compartment totals must not exceed the Allowable Load entry in the Preliminary Estimate box.

(14) Ref. 12.—Enter the sum of the figures opposite Ref. 10 and the compartment totals under Ref. 11 opposite "TAKE-OFF CONDITION (Uncorrected)." At this point, if not already done, calculate and enter the "Moment" or progressive "Index" for Ref. 2 to 12 inclusive.

(15) Check the weight figure opposite Ref. 12 against the Recommended Maximum Take-Off Gross Weight in the Limits Table. Check the "Index" or "Moment" figure opposite Ref. 12 by means of the balance computer or chart E respectively, to ascertain that the indicated CG is within allowable limits.

(16) If changes in amount or distribution of load are required, indicate necessary adjustments by proper entries in the Correction Table. Enter a brief description of the "adjustment" made in the column marked "ITEM". Add all weight and moment *decreases* and insert the total in the space opposite "Total Weight Removed." Add all weight *increases* and insert the total in the space opposite "Total Weight Added." Subtract the smaller from the larger of the two totals and enter the difference (with applicable + or — sign) opposite "Net Difference." Transfer these "Net Difference" figures to the spaces opposite Ref. 13.

(17) Ref. 14.—Enter the sums of or the differences between Ref. 12 and Ref. 13. Recheck to assure that these figures do not exceed allowable limits.

(18) By referring to the Center of Gravity Graph on chart E, or to the Center of Gravity Grid on the balance computer, compute the take-off CG position in terms of % M.A.C. Enter this figure in the space provided opposite "Take-Off CG IN % M.A.C."

(19) Secure necessary approval and signatures at the bottom of the form.